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## Supplemental Materials

for

### How Undergraduate Science Students Use Learning Objectives to Study

Bethany Osueke<sup>#</sup>, Birook Mekonnen<sup>#</sup>, and Julie Dangremond Stanton<sup>\*</sup>

*Department of Cellular Biology, University of Georgia, Athens, GA, 30602*

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<sup>\*</sup>Corresponding author. Mailing address: Department of Cellular Biology, 724 Biological Sciences Building, Athens, Georgia 30602-2607. Phone: 706-542-2978. Fax: 706-542-4271. E-mail: [stantonj@uga.edu](mailto:stantonj@uga.edu). Received: 20 October 2017, Accepted: 16 April 2018, Published: 29 June 2018.

<sup>#</sup>denotes co-first authors

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**Appendix 1**  
**Learning Objectives Assignment One**  
**(LOA1)** *Given after Exam One*

Name: \_\_\_\_\_

ID Number: \_\_\_\_\_

Email: \_\_\_\_\_

**BCMB3100 Learning Objectives Assignment One**  
*Worth 3 extra credit points*

**1) Your instructors provide learning objectives for each biochemistry class. In your view, what is the purpose of providing these learning objectives?**

**2) Did you use the learning objectives while studying for exam one in biochemistry?**

\_\_\_ yes (continue to question 3)

\_\_\_ no (skip to question 4 on the back of this page)

**3) If you answered yes to question 2: Please answer the following questions.**

a) How helpful did you find the learning objectives as you studied for exam one?

b) Why were the learning objectives helpful (or not) as you studied for exam one?

c) How did you use the learning objectives while studying for exam one?

d) What other ways did you study for exam one?

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e) How well did the learning objectives match up with the concepts covered on the exam?

*Please continue to question 5.*

**4) If you answered *no* to question 2: Please answer the following questions.**

a) How did you study for exam one?

b) Why did you decide not to use the learning objectives while studying for exam one?

**5) For all students: Do you plan to use the learning objectives to prepare for your next exam? If so, how do you plan to use them?**

*Thank you for your help.*

**Appendix 2**  
**Learning Objectives Assignment Two**  
**(LOA2)** *Given after Exam Two*

Name: \_\_\_\_\_

ID Number: \_\_\_\_\_

Email: \_\_\_\_\_

**BCMB3100 Learning Objectives Assignment Two**  
*Worth three extra credit points*

1) Please describe any instruction you have received (in this class or any other class) on how to use learning objectives for studying.

2) Did you use the BCMB3100 learning objectives to study for exam two in this class?

\_\_\_ yes (continue to question 3)

\_\_\_ no (skip to question 4 on the back of this page)

3) If you answered yes to question 2: Please answer the following questions.

a) Based on your experience, what advice would you give to future students on how to use the BCMB 3100 learning objectives effectively for studying? *Please be as specific as possible so another student could follow your approach.*

b) What other advice would you give to future students who want to study effectively for BCMB3100?

*Thank you for your help!*

**4) If you answered *no* to question 2: Please answer the following questions.**

a) Based on your experience, what advice would you give future students on how to study effectively for BCMB3100? *Please be as specific as possible so another student could follow your approach.*

b) What advice would you give future students about the BCMB3100 learning objectives? *Even though you didn't use the learning objectives to study for exam two, what would you say if a future student asked you about them?*

*Thank you for your help!*

## **Appendix 3: Supplemental Methods and Supplemental Results**

### **SUPPLEMENTAL METHODS**

#### **Qualitative data analysis: coding to consensus as a rigorous alternative to calculating inter-rater reliability**

To analyze our qualitative data, we used an iterative process in which we coded increments of the data as individuals and then coded to consensus as a group. This approach was appropriate because each of us brought a unique perspective to the data: as an instructor (JDS), as an undergraduate biology major (BM), and as an undergraduate pharmaceutical sciences major (BO). We wanted to discover nuanced details, which could have been disregarded if our aim was a high inter-rater reliability (1-3). Researchers have cautioned against the "myth of inter-rater reliability" with regards to qualitative data (4). Studies of coding have shown that qualitative researchers can agree, or be made to agree, for the purposes of inter-rater reliability, but this does not necessarily reflect the reality of the data nor does it necessarily ensure greater validity (5, 6). For these reasons, we used consensus coding to ensure rigor in our analysis.

### **SUPPLEMENTAL RESULTS**

#### ***What do students think is the purpose of learning objectives?***

Students in our study reported on their perceptions of the purpose of learning objectives. Most of their answers (83.8%) fit into three categories: 1) to give information for studying (40.5%), 2) to provide organization for studying (27.6%), or 3) to allow instructors to communicate with students (15.7%).

Many students (40.5%) viewed learning objectives as a source of information for studying. Specifically, students said the purpose of learning objectives is to reduce the scope of their studying. One student reported:

*"Learning objectives help us focus on the topics which are most important and help guide our studying for exams."*

Other students described learning objectives as study guides. The notion of a "study guide" meant different things to different students throughout the data. For example, some students wrote about the use of learning objectives as a study guide to ensure understanding of course concepts, while other students wrote about using learning objectives as a study guide to understand what they needed to know for exams.

Several students (27.6%) viewed the learning objectives as a tool to organize their studying. They wrote about learning objectives acting as an outline and providing direction when using various resources such as the textbook, case studies, and PowerPoint slides from class. Some students also perceived learning objectives as a way to help them with the "big picture" while also serving as an organizing framework. One student explained:

*"These learning objectives are used to highlight main ideas of concepts that should be fundamentally understood as a foundation to further expand your knowledge on the detail of the concepts."*

Some students (15.7%) saw the main purpose of learning objectives to be a communication tool between the instructors and the students. They described the learning objectives as a way of communicating expectations or the topics that would be covered. A student reported:

*"Providing the learning objectives gives the student the opportunity to know what the teacher expects you to learn."*

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